

WHAT IS CLAIMED IS:

1. An electric cell comprising a positive electrode, a negative electrode containing aluminum or aluminum alloy, and an electrolyte arranged between the positive electrode and the negative electrode, wherein

the electrolyte includes:

at least one ion selected from a group of a sulfate ion (SO_4^{2-}) and a nitrate ion (NO_3^-); and

an additive selected from a group of an organic acid, a salt of the organic acid, an hydrate of the organic acid, an ester of the organic acid, an ion of the organic acid, and derivatives thereof.

2. An electric cell comprising a positive electrode, a negative electrode containing aluminum or aluminum alloy, and an electrolyte arranged between the positive electrode and the negative electrode, wherein

the electrolyte includes at least one ion selected from a group of a sulfate ion (SO_4^{2-}) and a nitrate ion (NO_3^-); and

the surface of the negative electrode is contacted with one selected from an organic acid, a salt of the organic acid, an hydrate of the organic acid, an ester of the organic acid, an ion of the organic acid, and derivatives thereof.

3. The electric cell as claimed in Claim 1, wherein the additive includes:

at least one functional group selected from a carboxylic group (COOH), a sulfonic group (SO_3H), a hydroxyl group (OH), and a nitro group (NO_2); and a derivative thereof.

4. The electric cell as claimed in Claim 2, wherein the surface of the negative electrode is contacted with at least one functional group selected from a carboxylic group (COOH), a sulfonic group (SO₃H), a hydroxyl group (OH), and a nitro group (NO₂); and a derivative thereof.

5. The electric cell as claimed in Claim 1, wherein the additives are a polymeric compound and a derivative thereof.

6. The electric cell as claimed in Claim 2, wherein the surface of the negative electrode is contacted with a polymeric compound and a derivative thereof.

7. The electric cell as claimed in Claim 1 or Claim 2, wherein the electrolyte contains a halogen ion.

8. An electric cell comprising a positive electrode, a negative electrode containing aluminum or aluminum alloy, and an electrolyte arranged between the positive electrode and the negative electrode, wherein

the electrolyte includes at least one ion selected from a group of a sulfate ion (SO₄²⁻) and a nitrate ion (NO₃⁻); and

the surface of the negative electrode includes an oxide layer containing at least one element selected from a group of chromium, sulfur, nitrogen, boron, carbon, and phosphorus.

25 9. The electric cell as claimed in Claim 8, wherein

the negative electrode includes an oxide layer containing: at least one of an organic acid selected from a group of sulfuric acid, nitric acid, oxalic

acid, chromic acid, boric acid, phosphoric acid, carbonic acid, sulfosalicylic acid, maleic acid, acetic acid, and carboxylic acid:

5 an ion of the organic acid;

a salt of the organic acid; and

derivatives thereof.

10. A cell comprising a positive electrode, a negative electrode containing aluminum or aluminum alloy, and an electrolyte arranged between the positive electrode and the negative electrode, wherein

the electrolyte includes:

at least one ion selected from a group of a sulfate ion (SO_4^{2-}) and a nitrate ion (NO_3^-); and an additive, where

the additive includes one of:

a heterocyclic organic compound containing nitrogen; and
a nitrogen-containing organic compound containing at least one
functional group selected from a group of an amino group, an imino group, an
azido group, and an azide group, an ion of the nitrogen-containing organic
compound, a salt of the nitrogen-containing organic compound, and
a derivative of the nitrogen-containing organic compound

11. The electric cell as claimed in one of Claims 1, 2, 8, and 10, wherein

the negative electrode comprises aluminum alloy with at least one

25 metal selected from a group of Mn, Cr, Sn, Ca, Mg, Pb, Si, In, and Zn.

12. The electric cell as claimed in Claim 9, wherein thickness of the oxide layer is from 0.1 nm to 1,000,000 nm.

5 13. The electric cell as claimed in Claim 12, wherein thickness of the oxide layer is from 5 nm to 50,000 nm.

14. The electric cell as claimed in Claim 12, wherein the amount of the organic acid to be introduced into the oxide layer satisfies

10⁻¹¹ ≤ y ≤ 0.1,

when the composition of an oxide coating film is defined as

$\text{Al}_2\text{O}_3 + z\text{XY}$

where X denotes Cr, S, N, B, C, or B, and Z is a given number.

15. The electric cell as claimed in Claim 3, wherein the additive is at least one selected from a group of:

methyl alcohol, ethyl alcohol, propyl alcohol, butyl alcohol, phenol, glycerol, glycolic acid, ethylene glycol, formic acid, acetic acid, propionic acid, oxalic acid, salicylic acid, sulfosalicylic acid, malic acid, tartaric acid, succinic acid, fumaric acid, phthalic acid, malonic acid, citric acid, maleic acid, lactic acid, butyric acid, pyruvic acid, benzoic acid, sulfobenzoic acid, nitromethane, sulfoaniline, sulfonyl nitorobenzene, polyvinyl alcohol, vinyl acetate, vinyl sulfonate, poly(sulfonate vinylbenzene), poly(vinyl acetate), methyl acetate, acetic anhydride, maleic anhydride, phthalic anhydride, diethyl malonate, sodium benzoate, 25 sodium sulfobenzoate, sulfoaniline chloride, chlorethyl acetate, dichlormethyl

acetate, poly (vinyl acetate potassium salt), poly (styrene lithium sulfonate), polyacrylate, and lithium polyacrylate.

16. The electric cell as claimed in Claim 3, wherein concentration of the
5 additive in the electrolyte is from 0.0001 to 40 % by weight.

17. The electric cell as claimed in Claim 3, wherein concentration of the
additive in the electrolyte is from 0.0001 to 30 % by weight.